

NETWORK ARCHITECTURE**COURSE DESCRIPTION**

This course, which is a part of the Arts and Communication Cluster, stresses the conceptual and practical skills necessary to design and manage networks. Course content, which is of the project-based format, allows students to interconnect workstations, peripherals, terminals, and other networking devices creating an integrated system where all devices speak the same language or protocol. The course will help prepare students to design, build, and maintain computer networks. The networking sub-cluster will help prepare students for the Network + examination and cover many areas of the Cisco Certified Networking Associates exam. Over 190,000 high-technology jobs are currently available in U. S. corporations for graduates and employment opportunities are increasing.

Prerequisites: **Information Technology Infrastructure**
Networking Essentials Recommended

Concurrent: Algebra I or Equivalent

Recommended Credit: 1

Recommended Grade Level: 10th, 11th, or 12th

NETWORK ARCHITECTURE STANDARDS

- 1.0 Students will interpret and demonstrate the principles of industrial safety standards associated with the network architecture industry.
- 2.0 Students will demonstrate an understanding of the fundamentals of networking and how networking components interact.
- 3.0 Students will analyze the open system interconnect (OSI) reference model, and identify the functions that pertain to each layer.
- 4.0 Students will analyze major network operating systems, such as Microsoft Windows NT, Novell NetWare, and Unix.
- 5.0 Students will analyze the Transmission Control Protocol/Internet Protocol (TCP/IP) family of protocols, IP addressing and address classifications, and name-resolution services available.
- 6.0 Students will compare utilities used to verify TCP/IP functionality on various Windows Operating Systems.
- 7.0 Students will demonstrate knowledge and skills to upgrade basic network software and hardware components.
- 8.0 Students will determine and select proper equipment and appropriate hardware, install appropriate software, configure hardware and software, and ensure proper protocols and security policies are in place to set up remote access on a network.
- 9.0 Students will select and install proper client software and ensure network security.
- 10.0 Students will analyze fault tolerance and disaster recovery.
- 11.0 The student will select and examine basic troubleshooting techniques to diagnose and correct network problems.
- 12.0 Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

NETWORK ARCHITECTURE**STANDARD 1.0**

Students will interpret and demonstrate the principles of industrial safety standards associated with the network architecture industry.

LEARNING EXPECTATIONS

The student will:

- 1.1 Implement the industrial safety standards established by the Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA).
- 1.2 Identify and categorize safety hazards and prevention in the network architecture industry.
- 1.3 Exhibit acceptable dress and personal grooming determined by the network architecture industry.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 1.1.A Establishes and maintains a safe working environment.
- 1.1.B Passes with 100% accuracy, a written safety examination.
- 1.2.A Distinguishes and employs measures to prevent and eliminate contaminants and ensure ecological, chemical, and physical safety.
- 1.2.B Maintains tools and equipment in a safe and clean condition.
- 1.3 Compares and contrasts appropriate and inappropriate dress and personal grooming characteristics for specific jobs within the network architecture industry.

SAMPLE PERFORMANCE TASK

- Conduct a self-inspection of the laboratory and identify modifications necessary for compliance with rules, regulations, and standards of governing agencies.
- Appraise the work area for safety hazards and list common causes of typical accidents and injuries in the network architecture industry.
- Outline a safety management program.
- Calculate the cost of safety corrections, including financial and environmental impact.
- Develop emergency policies for the network architecture laboratory.
- Role-play scenarios involving appropriate and inappropriate dress and personal grooming for the network architecture industry.
- Participate in the Occupational Safety and Health competitions in Tennessee SkillsUSA-VICA.

INTEGRATION LINKAGES

SkillsUSA-VICA, Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA), Secretary's Commission on Achieving Necessary Skills (SCANS), CompTIA, *Professional Development Program* - SkillsUSA-VICA, Science, Electronics, Math, Language

Arts, Teambuilding Skills, Communication Skills, Critical-Thinking Skills, Computer Skills,
Internet Navigation

NETWORK ARCHITECTURE

STANDARD 2.0

Students will demonstrate an understanding of the fundamentals of networking and how networking components interact.

LEARNING EXPECTATIONS

The student will:

- 2.1 Differentiate a wide area network (WAN) and local area network (LAN).
- 2.2 Compare and contrast a server, workstation, host, and client.
- 2.3 Analyze server-based networking and peer-to-peer networking.
- 2.4 Evaluate the characteristics of star, bus, mesh, and ring topologies, their advantages and disadvantages.
- 2.5 Research the characteristics of segments and backbones.
- 2.6 Define flow control and describe basic methods used in networking.
- 2.7 Compare the advantages and disadvantages of coax, Cat 3, Cat 5, fiber optic, UTP, and STP, and the conditions under which they are appropriate.
- 2.8 Recognize the visual appearance of RJ45 and BNC and how they are crimped.

PERFORMANCE STANDARD: EVIDENCE STANDARD IS MET

The student:

- 2.1 Develops a presentation explaining WAN and LAN.
- 2.2 Describes the differences between Server/Host and Workstation/Client.
- 2.3 Associates server-based and peer-to-peer networking.
- 2.4 Compares the advantages and disadvantages of star, bus, mesh, and ring topologies.
- 2.5 Demonstrates the characteristics of segments and backbones.
- 2.6 Charts information flow.
- 2.7 Defines the length and speed of 10Base2, 10Base5, 100BaseTX, 100Base FX, 1000BaseTX, and 1000BaseFX.
- 2.8 Constructs a Cat 5 cable.

SAMPLE PERFORMANCE TASK

- Construct and test a peer-to-peer network.
- Diagram a star, bus, mesh, and ring topologies.
- Choose one topology and properly connect.
- Describe coax, Cat 3, Cat 5, fiber optic, Unshielded Twisted Pair (UTP), and Shielded Twisted Pair (STP) and when each is used.
- Build and test a Cat 5 cable.

INTEGRATION LINKAGES

SkillsUSA-VICA, Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA), Secretary's Commission on Achieving Necessary Skills (SCANS), *Professional Development Program* - SkillsUSA-VICA, CompTIA, Cisco Networking Technologies,

Computer Skills, Science, Electronics, Networking Skills, Math, Language Arts, Teambuilding Skills, Communication Skills, Critical-Thinking Skills, Internet Navigation Skills

NETWORK ARCHITECTURE

STANDARD 3.0

Students will analyze the open system interconnect (OSI) reference model, and identify the functions that pertain to each layer.

LEARNING EXPECTATIONS

The student will:

- 3.1 Evaluate the three categories of the open system interconnect (OSI) model.
- 3.2 Evaluate the protocols, services, and functions that pertain to each layer of the open system interconnect (OSI) reference model.

PERFORMANCE STANDARD: EVIDENCE STANDARD IS MET

The student:

- 3.1.A Analyzes the network layer of the open system interconnect (OSI) reference model.
- 3.1.B Analyzes the data link layer of the open system interconnect (OSI) reference model.
- 3.1.C Analyzes the physical layer of the open system interconnect (OSI) reference model.
- 3.1.D Analyzes the functions of each layer of the open system interconnect ISO/OSI reference model.
- 3.2.A Appraises the values of bridges and switching devices.
- 3.2.B Installs LAN switching devices.
- 3.2.C Creates broadcast domains.
- 3.2.D Evaluates the strengths and weaknesses of various topologies relating to underlying cable.
- 3.2.E Locates and implements industry standards, such as the Electronic Industry Association/Telecommunications Industry Association (EIA/TIA) 568 specifications.
- 3.2.F Builds a path between LAN segments that will filter the flow of data packets.
- 3.2.G Uses routers to impose logical structure.
- 3.2.H Relates protocols, services, and functions to the open system interconnect (OSI) model.

SAMPLE PERFORMANCE TASK

- List the key internetworking functions of the open system interconnect (OSI) Network layer.
- Draw and label the open system interconnect (OSI) model.
- List reasons the information technology industry uses a layered model.
- Develop a presentation on collision domains and broadcast domains that explains how they affect the performance of the network.
- Perform a cable audit to identify areas that need upgrades and rewiring.
- Add router ports.

INTEGRATION LINKAGES

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NETWORK ARCHITECTURE

STANDARD 4.0

Students will analyze major network operating systems, such as Microsoft Windows NT, Novell NetWare, and Unix.

LEARNING EXPECTATIONS

The student will:

- 4.1 Research client base served by specific network operating systems and operating system resources.
- 4.2 Analyze the directory services of major network operating systems.

PERFORMANCE STANDARD: EVIDENCE STANDARD IS MET

The student:

- 4.1.A Outlines characteristics of network operating systems and resources.
- 4.1.B Outlines characteristics of particular clients to determine networking operating systems.
- 4.2.A Logs on to the directory tree and makes changes.
- 4.2.B Adds and deletes users on the directory service.

SAMPLE PERFORMANCE TASK

- Install and test client software for a given operating system.
- Create new users and set up their rights.

INTEGRATION LINKAGES

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NETWORK ARCHITECTURE

STANDARD 5.0

Students will analyze the TCP/IP family of protocols, IP addressing and address classifications, and name-resolution services available.

LEARNING EXPECTATIONS

The student will:

- 5.1 Differentiate standard protocols and research their advantages and disadvantages.
- 5.2 Explain the concept of IP default gateways and the purpose and use of dynamic host configuration protocol (DHCP), domain name service (DNS), Windows Internet Naming Service (WINS), and host files.
- 5.3 Evaluate the main protocols that make up the TCP/IP suite, including TCP, user datagram protocol (UDP), post office protocol (POP3), simple mail transfer protocol (SMTP), simple network management protocol (SNMP), file transfer protocol (FTP), hypertext transfer protocol (HTTP), and IP.
- 5.4 Discuss the fundamental concepts of TCP/IP classes, addressing, and port numbers.

PERFORMANCE STANDARD: EVIDENCE STANDARD IS MET

The student:

- 5.1.A Evaluates the findings of research on standard protocols: TCP/IP, inter-network package exchange (IPX), and netbios extended user interface (NetBEUI).
- 5.1.B Compares a network monitor and a network or protocol analysis.
- 5.2 Installs and configures standard protocols.
- 5.3 Demonstrates the use of main protocols that make up the TCP/IP suite, including TCP, UDP, POP3, SMTP, SNMP, FTP, HTTP, and IP.
- 5.4.A Researches the differences between the A, B, and C classes of IP addresses and their default subnet mask numbers.
- 5.4.B Evaluates the use of assigned port numbers for HTTP, FTP, and SMTP and port numbers commonly assigned to other services.

SAMPLE PERFORMANCE TASK

- Determine when each protocol is to be used.
- Network two computers using appropriate protocol and test.
- Establish IP default network command using dynamic routing protocols.

INTEGRATION LINKAGES

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NETWORK ARCHITECTURE

STANDARD 6.0

Students will compare utilities used to verify TCP/IP functionality on various Windows Operating Systems.

LEARNING EXPECTATIONS

The student will:

- 6.1 Explain how and when to use the proper TCP/IP utilities to test, validate, and troubleshoot IP connectivity.
- 6.2 Troubleshoot IP connectivity.

PERFORMANCE STANDARD: EVIDENCE STANDARD IS MET

The student:

- 6.1A Demonstrates the use of the ARP utility and explains its function.
- 6.1B Explains the use of the Telnet utility and demonstrates its function.
- 6.1C Researches the use of the tracert utility and explains its function.
- 6.1D Demonstrates the use of the netstat utility and explains its function.
- 6.1E Compares the use of the ipconfig and winipcfg and explains its function.
- 6.1F Evaluates the use of the FTP utility and demonstrates its function.
- 6.2A Demonstrates the use of the ping utility and explains its function.
- 6.2B Diagnoses and verifies operating system errors.
- 6.2C Repairs and evaluates operating systems.

SAMPLE PERFORMANCE TASK

- Determine which utility is to be used in a given situation.
- Demonstrate the use of the utilities in a real network environment.
- Diagnose and evaluate the results of the utilities.

INTEGRATION LINKAGES

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NETWORK ARCHITECTURE

STANDARD 7.0

Students will demonstrate knowledge and skills to upgrade basic network software and hardware components.

LEARNING EXPECTATIONS

The student will:

- 7.1 Demonstrate understanding of the need for administrative and test accounts, passwords, IP addresses, IP configurations, and relevant standard operating procedure (SOP) prior to network implementation.
- 7.2 Analyze the impact of environmental factors on computer networks.
- 7.3 Recognize visually and comprehend verbal and written descriptions of common peripheral ports, external SCSI (especially DB-25 connectors), and common network components.
- 7.4 Analyze uses of RJ-45 connectors, comparing the contributions of cabling and patch cables to the overall length of the cabling segment.

PERFORMANCE STANDARD: EVIDENCE STANDARD IS MET

The student:

- 7.1 Creates a list of test accounts, passwords, IP addresses and configurations, and SOP.
- 7.2.A Evaluates environmental conditions of the room for humidity, heat, and air circulation.
- 7.2.B Evaluates the placement of furniture, air conditioning vents, electronic equipment, and the condition of computer equipment.
- 7.3 Researches existing print servers, hubs, routers, bridges, patch panels, UPSs, and NICs, and reports existence and condition.
- 7.4 Evaluates an installation, configuration, or troubleshooting scenario and selects an appropriate course of action.

SAMPLE PERFORMANCE TASK

- In the event a client workstation does not connect to the network after installing or replacing a network interface card, evaluate work operations and make appropriate corrections to the problem.
- Develop a Power Point presentation showing the users, passwords, IP address, and SOP.
- Develop a plan showing the proper room conditions for network installation.
- Demonstrate proper troubleshooting procedures.
- Perform an actual upgrade on an existing server.
- Given a network installation scenario, identify unexpected or atypical conditions that could either cause problems for the network or signify that a problem already exists.

INTEGRATION LINKAGES

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Computer Skills, Science, Electronics, Networking Skills, Math, Language Arts, Teambuilding Skills, Communication Skills, Critical-Thinking Skills, Internet Navigation Skills

NETWORK ARCHITECTURE**STANDARD 8.0**

Students will determine and select proper equipment and appropriate hardware, install appropriate software, configure hardware and software, and ensure proper protocols and security policies are in place to set up remote access on a network.

LEARNING EXPECTATIONS

The student will:

- 8.1 Examine the purpose and function of PPP (point-to-point protocol), serial line interface protocol (SLIP), point-to-point tunneling protocol (PPTP), integrated service digital network (ISDN), public switched telephone network (PSTN), and post office protocol (POTS).
- 8.2 Demonstrate the modem configuration parameters that must be set, including serial port interrupted request (IRQ), input/output (I/O) address, and maximum port speed for a remote connection.

PERFORMANCE STANDARD: EVIDENCE STANDARD IS MET

The student:

- 8.1 Researches the proper use of PPP, SLIP, PPTP, ISDN, PSTN, and POTS.
- 8.2 Configures modem parameters including serial port IRQ, I/O address, and maximum port speed for a remote connection.

SAMPLE PERFORMANCE TASK

- Use modem's properties to troubleshoot the client complaint "I can't connect to the Internet."
- Discuss serial ports (COM) and parallel ports (LPT) as related to IRQs and I/O addresses.
- Research the rules of IRQs.

INTEGRATION LINKAGES

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NETWORK ARCHITECTURE

STANDARD 9.0

Students will select and install proper client software and ensure network security.

LEARNING EXPECTATIONS

The student will:

- 9.1 Research network management involving network documentation, network security, environmental factors, network performance, server administration, and network troubleshooting.
- 9.2 Analyze networking systems, determine problems, and make corrections.
- 9.3 Manage an advanced networking system.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 9.1.A Analyzes the network administrator memory.
- 9.1.B Maintains a secure network.
- 9.1.C Sets standards to control environmental factors.
- 9.1.D Maintains network performance.
- 9.1.E Manages peer-to-peer and client/server networks.
- 9.2 Sets up operating procedure manual for a network.
- 9.3.A Completes an engineer's journal for documenting the network management.
- 9.3.B Completes a systematic analysis of the network.

SAMPLE PERFORMANCE TASKS

- Maintain diagrams of the physical wiring layout, cable information, and wiring schematic.
- Develop a plan for protecting equipment involving electrical irregularities, electromagnetic interference (EMI), and viruses.
- Record several types of network performance data.
- Perform network troubleshooting.

INTEGRATION LINKAGES

SkillsUSA-VICA, Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA), Secretary's Commission on Achieving Necessary Skills (SCANS), *Professional Development Program* - SkillsUSA-VICA, CompTIA, Cisco Networking Technologies, Computer Skills, Science, Electronics, Networking Skills, Math, Language Arts, Teambuilding Skills, Communication Skills, Critical-Thinking Skills, Internet Navigation Skills, Connectivity Skills

NETWORK ARCHITECTURE

STANDARD 10.0

Students will analyze fault tolerance and disaster recovery.

LEARNING EXPECTATIONS

The student will:

- 10.1 Evaluate various types of RAID technology.
- 10.2 Analyze volumes as related to the hard drive.
- 10.3 Research the various types of standard backup procedures and backup media storage practices.
- 10.4 Evaluate the need for periodic applications of software patches and other fixes to the network.

PERFORMANCE STANDARD: EVIDENCE STANDARD IS MET

The student:

- 10.1.A Defines mirroring and the associated RAID level.
- 10.1.B Defines duplexing and the associated RAID level.
- 10.1.C Defines stripping (with and without parity) and the associated RAID level.
- 10.2 Describes volumes and how they are used.
- 10.3.A Explains various types of tape backup and gives the purpose of each.
- 10.3.B Comprehends the need to install antivirus software on the server and workstations and the need to frequently update virus signatures.
- 10.4 Analyze test documentation available regarding a vendor's patches, fixes, and upgrades.

SAMPLE PERFORMANCE TASK

- Develop a Power Point presentation showing the different types of RAID technology.
- Describe relationship between hard drive and volume as related to security.
- Implement a tape backup.
- Demonstrate standard backup procedures and backup media storage practices.
- Demonstrate a hard drive recovery system process.

INTEGRATION LINKAGES

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NETWORK ARCHITECTURE**STANDARD 11.0**

The student will select and examine basic troubleshooting techniques to identify and correct network problems.

LEARNING EXPECTATIONS

The student will:

- 11.1 Analyze the proper steps to a systematic approach to identifying the extent of a network problem and, given a problem scenario, select the appropriate next step based on this approach.
- 11.2 Demonstrate awareness of the need to check for physical and logical indicators of trouble.
- 11.3 Research a network problem scenario, including symptoms and determine the most likely cause(s) of the problem based on the available information. Select the most appropriate course of action based on this inference.
- 11.4 Specify the tools that are commonly used to resolve network equipment problems and describe the purpose and function of common network tools.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 11.1A Determines whether the problem exists across the network.
- 11.1B Analyzes workstation, workgroup, LAN, or WAN for faults or problems.
- 11.1C Decides whether the problem is consistent and replicable.
- 11.1D Identifies the exact issue, re-creates the problem, isolates the cause, and formulates a correction.
- 11.1E Implements the correction, tests, documents the problem and the solution, and gives feedback.
- 11.1F Has a second operator perform the same task on an equivalent workstation and on the original operator's workstation.
- 11.2 Verifies link lights, power lights, error displays, error logs and displays, and performance monitors.
- 11.3 Recognizes abnormal physical conditions; isolates and corrects problems in cases where there is a fault in the physical media (patch cable); checks for configuration problems; checks for viruses; checks the validity of the account name and password.
- 11.4 Demonstrates the use of the following tools: hardware loopback, tone generator, and tone locator (fox and hound).

SAMPLE PERFORMANCE TASKS

- Complete a systematic analysis of the network.
- Analyze the network administrator's memory.
- Maintain a secure network.
- Set standards to control environmental factors.

- Maintain network performance.
- Manage peer-to-peer and client/server networks.
- Set up operating procedure manual for a network.
- Complete an engineer's journal for documenting the network management.

INTEGRATION LINKAGES

SkillsUSA-VICA, Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA), Secretary's Commission on Achieving Necessary Skills (SCANS), *Professional Development Program* - SkillsUSA-VICA, CompTIA, Cisco Networking Technologies, Computer Skills, Science, Electronics, Networking Skills, Math, Language Arts, Teambuilding Skills, Communication Skills, Critical-Thinking Skills, Internet Navigation Skills

NETWORKING ARCHITECTURE

STANDARD 12.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

LEARNING EXPECTATIONS

The student will:

- 12.1 Demonstrate positive leadership skills in the classroom and community.
- 12.2 Participate in SkillsUSA-VICA as an integral part of classroom instruction.
- 12.3 Investigate how technology has made an impact on networking architecture in the past two years.
- 12.4 Construct a job search network.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 12.1 Serves as a volunteer in the community.
- 12.2.A Applies the points of the creed to personal and professional situations.
- 12.2.B Completes a job search for employment opportunities.
- 12.3.A Writes a technical report that shows technological advancements in networking architecture.
- 12.4.A Refines an employment portfolio.
- 12.4.B Assists with an officer campaign with Tennessee SkillsUSA-VICA.

SAMPLE PERFORMANCE TASKS

- Create a leadership inventory and use it to conduct a personal assessment.
- Participate in various SkillsUSA-VICA programs and/or competitive events.
- Analyze entry-level job skills and demonstrate proficiency in each skill.
- Implement an annual program of work.
- Attend a professional organization meeting.
- Participate in the Community Service competition with SkillsUSA-VICA.

INTEGRATION LINKAGES

SkillsUSA-VICA, *Professional Development Program*, SkillsUSA-VICA, Communications and Writing Skills, Teambuilding Skills, Research, Language Arts, Sociology, Psychology, Math, Math for Technology, Applied Communication, Social Studies, Problem Solving, Interpersonal Skills, Employability Skills, Critical-Thinking Skills, SCANS (Secretary's Commission on Achieving Necessary Skills), Chamber of Commerce, Colleges, Universities, Technology Centers, and Employment Agencies